Remarks

Introduction

Applicants thank the Examiner for carefully considering the subject application.

However, before addressing the claims in detail, Applicants believe that it would be useful to review several details of the application. The present application relates to a method of controlling an internal combustion engine based on a predicted engine operating event and a determined oxygen content of exhaust gases downstream of a catalyst. In particular, in one embodiment, engine air-fuel is enriched while the engine is at idle in anticipation of a pending tip-in (or acceleration). By enriching engine air-fuel prior to a tip-in, engine exhaust gases can precondition a catalyst in the exhaust flow path so that during a tip-in higher catalyst conversion efficiency may result. See paragraphs [0008]-[0009], [0041], and [0045], for example, of Applicants' specification.

Consequently, in one example, NOx emissions may be reduced during a tip-in event by providing additional CO to the catalyst, see FIG. 7a-7d, of Applicants' specification, for example.

Rejection of Claims 1-5 and 8-13 under 35 U.S.C. 102(b)

The Examiner has rejected claims 1-5 and 8-12 under 35 U.S.C. 102(b) as being anticipated by Nasu, U.S. Patent 5,475,975. Applicants respectfully submit that Nasu does not teach all of the limitations of amended Claim 1.

Amended Claim 1 recites:

> A method of controlling an internal combustion engine of a vehicle, the engine communicating exhaust gases to a catalyst, the method comprising:
> predicting a future engine operating event that will change an exhaust gas constituent in the engine exhaust gases;
> measuring an oxygen sensor in exhaust gases downstream of the catalyst coupled to the engine, and adjusting said measurement based at least on a temperature of said oxygen sensor; and
> adjusting an air-fuel ratio of the engine based on said adjusted measurement and said predicted engine operating event.

On page 2, paragraph 2, the Examiner states that Nasu shows "predicting a future engine operating event that will change an exhaust gas constituent in the exhaust gases", and cites column 8, lines 11-67, column 9, lines 1-67, and column 10, lines 1-44. Applicants have reviewed the citation, and do not find a description of "predicting a future engine operating event that will change an exhaust gas constituent in the engine exhaust gases". In column 8, lines 44-53, Applicants find the following description:

> However, since the change in the output V_{O2} (i.e., the change in the air-fuel ratio of the exhaust gas downstream of the catalytic converter 12) during the period between the moments t_3 and t_3* corresponds to the change in the upstream air-fuel ratio A/F during the past period between moments t_1 and t_3 which precedes by the time period d, it is possible to predict the future value of the output V_{O2} (i.e., value at the moment t_3*) at the present time (i.e., the moment t_3) based on the history of the change in the upstream air-fuel ratio A/F during the past period between moments t_1 and t_3.

In other words, Nasu attempts to predict an output voltage of a sensor located after a catalyst, based on engine exhaust gas flow into the catalyst. Nasu does not predict "a future engine operating event that will change an exhaust gas constituent in the engine exhaust gases". Specifically, Nasu attempts to predict a sensor voltage based on "the change in the upstream air-fuel

ratio A/F during the past period". In other words, Nasu does not predict or attempt to predict a future engine event; Nasu simply attempts to predict a sensor voltage that may be affected by exhaust gas constituents passing through a catalyst.

In addition, Nasu makes no mention or suggestion of adjusting an oxygen sensor measurement based on a temperature of the oxygen sensor. Specifically, Nasu does not mention or suggest "measuring an oxygen sensor in exhaust gases downstream of the catalyst coupled to the engine, and adjusting said measurement based at least on a temperature of said oxygen sensor".

Accordingly, Applicants respectfully submit that amended claim 1 should be allowed. Furthermore, claims 9 and 13 recite similar limitations and should be allowed as well.

With respect to claims 2, 3, 5, and 8 as described above, Nasu fails to show the limitations of Applicants' claim 1 from which claims 3, 5, 8 depend.

In addition, as described above, Nasu fails to show the limitations of Applicant's claim 9 from which claims 10, 11 and 12 depend. Therefore, Applicants' respectfully request the allowance of claims 2, 3, 4, 5, 8, 10, 11, and 12.

Rejection of Claims 1-5, 8-13 under 35 U.S.C. 102(e)

The Examiner has rejected claims 1-5, 8-13 under U.S.C. 102(e) as being anticipated by Lewis et al. U.S. Patent 6,470,675. As described above, amended claims 1, 9, and 13 recite similar limitations that include "measuring an oxygen sensor in exhaust gases downstream of the catalyst coupled to the engine, and adjusting said measurement based at least on a temperature of said oxygen sensor". The Examiner has cited Lewis

et al. column 11, lines 25-64. However, Applicants can find no mention or suggestion, in the cited reference, or elsewhere in Lewis et al., that shows adjusting an oxygen sensor measurement based on a temperature of an oxygen sensor, and then using the adjusted measurement and a predicted engine operating event as a basis to adjust an engine air-fuel ratio.

Therefore, Applicants submit that claims 1, 9, 13 should be allowed. Furthermore, claims 2-8, and 10-12 depend from claims 1 and 9 respectively, and therefore should be allowed as well.

New Claims 14-17

Claims 14-17 have also been added. Claim 14 is set forth as follows:

> A method of controlling an internal combustion engine of a vehicle, the engine communicating exhaust gases to a catalyst, the method comprising:
>
> a first mode of operation wherein a first oxygen sensor located upstream of at least a catalyst determines a first air-fuel mixture of said internal combustion engine, and wherein a second oxygen sensor is located downstream of said at least a catalyst, and wherein a controller adjusts a first engine fuel amount based on said first oxygen sensor and not based on said second sensor;
>
> a second mode of operation wherein said upstream oxygen sensor determines a second air-fuel mixture of said internal combustion engine, and wherein a future engine operating event that will change an engine exhaust gas constituent in the engine exhaust gases is predicted, and wherein an oxygen content downstream of a catalyst coupled to said engine is determined, and wherein said controller adjusts a second engine fuel amount based at least on said determined second air-fuel mixture, said predicted future engine operating event, and said downstream oxygen content; and
>
> operating in said first mode during a first temperature of said second oxygen sensor, and operating in said second mode of operation during a second temperature of said second oxygen sensor.

Claim 14 describes a method for controlling an engine that includes two separate operating modes to adjust engine fuel. The first mode uses an upstream oxygen sensor and does not use a

prediction of an engine operating event to adjust engine fuel. The second mode uses an upstream oxygen sensor and also uses a prediction of an engine operating event to adjust engine fuel. The engine can be operated in the first or second operating mode at different temperatures of a downstream oxygen sensor.

Applicants have recognized that during certain engine operating conditions it may not be useful to use catalyst air-fuel control because rear (downstream) oxygen sensor information may not be reliable, see Applicants' specification paragraph [0030] and [0041], for example. In one example, Applicants have provided a solution that may reduce the possibility of using unreliable sensor information. Specifically, Applicant's specification states that "The Catalyst air/fuel controller 110 is not used at this time because the rear oxygen sensor 53 does not provide reliable information until a certain sensor operating temperature has been reached". Later in the same paragraph, Applicant's specification states that "When the rear oxygen sensor 53 has reached a temperature where it functions, (about 600 degrees F), the Catalyst controller 110 begins to work". In other words, operation of the catalyst air-fuel controller can be determined by engine operating conditions. Furthermore, in paragraph [0041], Applicant's specification goes on to state that "...the above-mentioned Preconditioning Bias is provided to Controller 110 in response to a prediction that an engine operating event that will result in a change in an exhaust gas constituent in the engine exhaust gases...". Consequently, the use of catalyst preconditioning bias, provided in response to a prediction of an engine operating event, can be determined by engine operating conditions.

Nowhere in Nasu nor Lewis et al. can Applicants find mention or suggestion of determining whether a prediction of a future

engine operating event may be used to adjust engine air-fuel based on a temperature of a downstream oxygen sensor. Therefore, Applicants respectfully request allowance of claim 14. In addition, claims 15-17 cite similar limitations, or are dependant upon similar limitations, and should be allowed as well.

Conclusion

Based on the above mentioned arguments, the above-identified applicant is believed to be in condition for allowance, and such allowance is courteously solicited.

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Respectfully submitted,

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